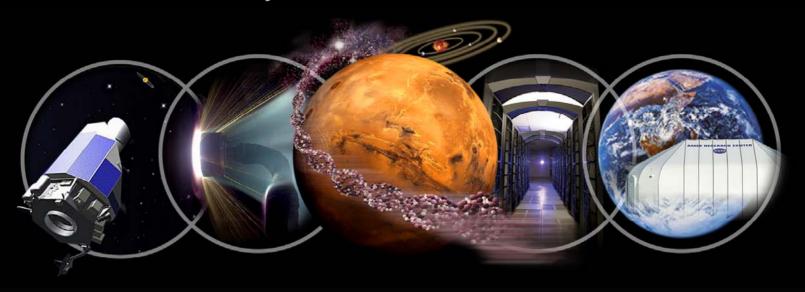
Discovery Innovation Solutions



# **Exploration Systems Technology Partnerships Forum**

G. Scott Hubbard NASA Ames Center Director

July 22, 2004















# The Vision for Space Exploration

- Implement sustained & affordable human/robotic program to explore the solar system and beyond
- Extend human presence across the solar system, starting with a human return to the Moon by the year 2020, in preparation for human exploration of Mars and other destinations
- Develop the innovative technologies, knowledge, and infrastructures both to explore and to support decisions about the destinations for human exploration
- Promote international and commercial participation in exploration to further U.S. scientific, security, and economic interests.

Pressurized Rovers for Transporting Cargo and Crew

ROGER ARNO



## NASA Ames Research Center Today -founded 1939

Science (Earth-Life-Space): Astrobiology- the study of life in the universe

#### **Science Missions**

- Stratospheric Observatory For Infrared Astronomy
- Kepler Mission-Search for Habitable Planets
- Space Station Biological Research Project

#### **Technology for Science and Exploration**

- Information Technology (Autonomy, Human Factors, High-End Computing)
- Nanotechnology
- Bio-Info-Nano Fusion
- Thermal Protection Systems

#### **Aviation and Aeronautics**

Air Traffic Management and Control

#### **Education**

**Innovative Collaborations** 

NASA Research Park
University Affiliated Research Center







### Vision for Space Exploration & Ames

#### Implement human/robotic program



- **Robotic Systems**
- **Space Human Factors**
- Science Operations
- Astrobiology
- Bioastronautics
- Biological contamination control/Sample return
- Radiation Biology Expertise

#### **Extend**

human presence



- Microgravity and radiation biology
- Systems Health Management
- Life Science instrument packagesHabitat design, construction & outfitting
- In-Situ Autonomous site preparation

#### **Develop**

innovative technologies



#### - Nanotechnology

- Information Technology
- Intelligent Robotics/Human Interactions
- Management Astrobiology Science Missions
- **TPS/Entry Technology**
- Materials Protective Systems TPS, Radiation

#### **Promote**

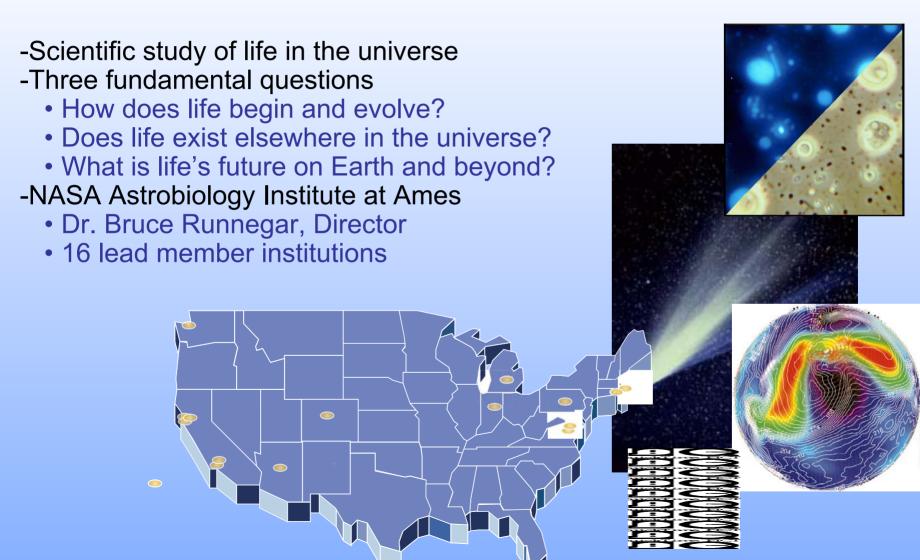
international & commercial participation



Leader in innovative partnerships and collaborations



# **Astrobiology**





### **SOFIA**

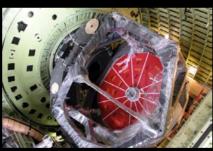
SOFIA will explore the infrared universe flying above interference from the Earth's water vapor atmosphere



Airborne observatory for Origins 2.8 m IR telescope in 747 aircraft 160 flights per year

Telescope successfully installed into modified 747 aircraft

Installation verified by full fuselage proof pressurization test.







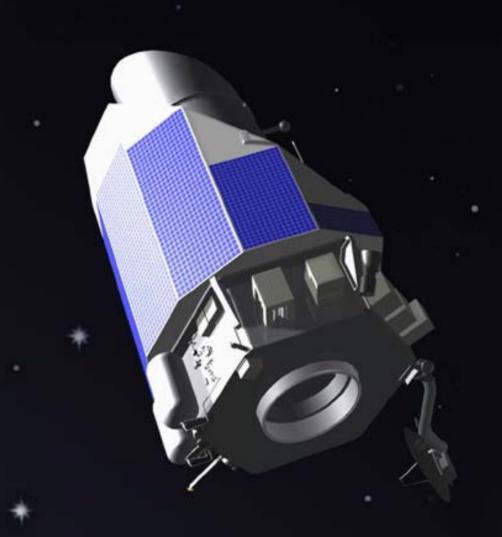


# To explore the universe and search for life: Kepler:The Search for Habitable Planets

Ames led Discovery Mission: PI- W. Borucki

Instrument & Mission Designs maturing

August 2007 Launch

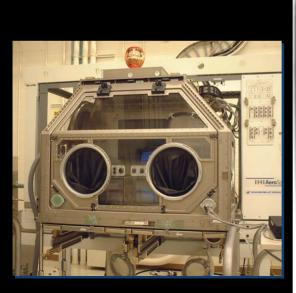




# **Space Station Biological Research Project**

- Science: Role of gravity in biology, adaptation of life in space

- Flight Hardware Glovebox, Habitat Rack, Incubator delivered

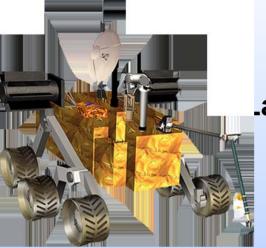








## Information Science & Technology



Mars Science Laboratory '09

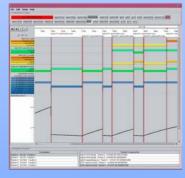
# Autonomy Human/machine Interface arge Data Sets and Datamining



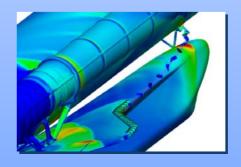
Super Computing



The latest Altix system



Integrated Vehicle Health Monitoring



Columbia Foam Strike Analysis



# Bio/Info/Nanotechnology

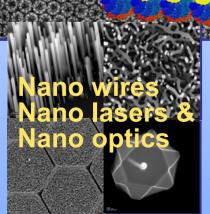
"NASA Ames - One of the largest single nanotechnology research centers in the world."\*



Gecko Feet Adhesive

Highly efficient





\* January 20, 2004 "Nanoscience and Nanotechnology: Opportunities and Challenges in California" report prepared by the California Council on Science and Technology for the state legislature.



# **Technology for Exploration**

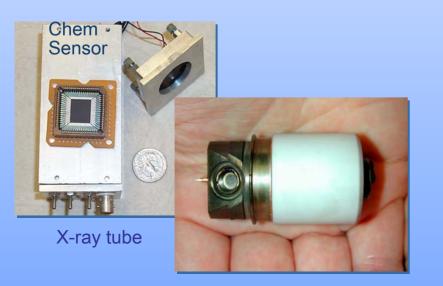
#### **Applications in nanotechnology**

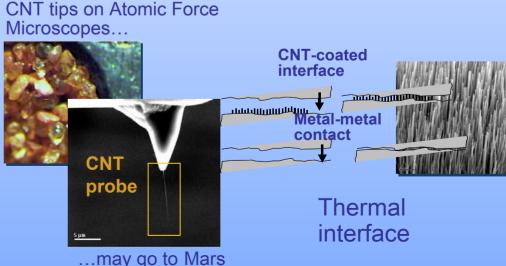
Established World Class base for future revolutionary capabilities

- -Next Generation thermal, radiation, & impact protective systems
- -Highly efficient life support systems
- -Extremely sensitive & selective life detection sensors

#### **Developed:**

- Carbon nanotube (CNT) based Chemical sensor
- X-ray tube for soil analysis instrument to fly on Mars-09 mission
- Probe for atomic force microscope to analyze Martian dust
- Nanotube-copper composite for advanced thermal control in space



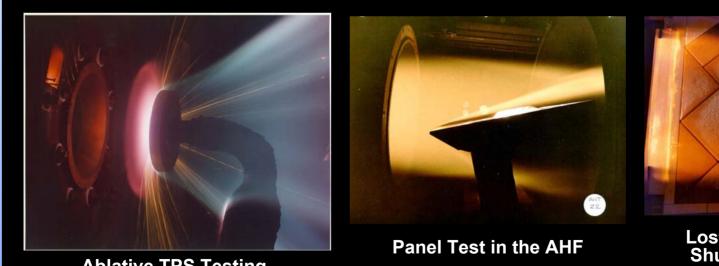




## **Thermal Protection Materials** and Arc-Jet Facility



Testing and materials for Mars Pathfinder and Mars Exploration Rovers Support for Shuttle, and future human vehicles



**Ablative TPS Testing** 

Lost tile test for **Shuttle Orbiter** 



Mars Exploration Rovers-Spirit & Opportunity

#### **Ames' Contributions**

Science discovery
3 Co-Investigators from Ames

**David Des Marais** 

**Natalie Cabrol** 

**Michael Sims** 

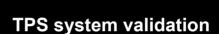
**Technology & Major Facilities Enabled the Mission** 

Thermal Protection Systems and Arc Jet Testing

Wind tunnel parachute testing

Mission systems software tools

**Human Factors/Mars Time** 



MER
Parachute
Testing in 80
by 120 foot
Wind Tunnel



Science & Engineering Collaboration Tools





## Air Traffic Management/Air Traffic Control





Air Traffic Management

Future Flight Central











## New Models: University Affiliated Research Center

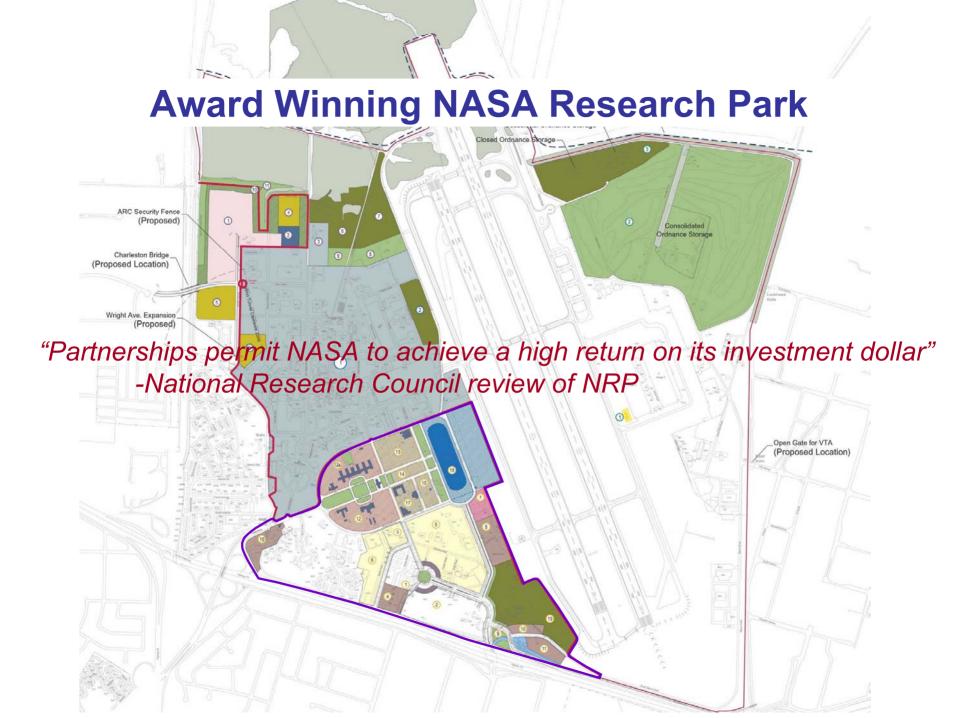
- NASA's first University Affiliated Research Center
  - 10 year, \$330 M contract between NASA Ames and University of California.
  - UC Santa Cruz is lead UC institution-Ranked 1st in Space Scien
  - Beyond grants and support contracts
  - Tasks that are part of NASA's critical milestones
  - Flexibility to change tasks as needs arise
  - •UC: 10 Campuses, 3 National Laboratories
  - •\$15B annual budget
  - •4 UC campuses rated among top 15 worldwide



**UC President**Robert Dynes

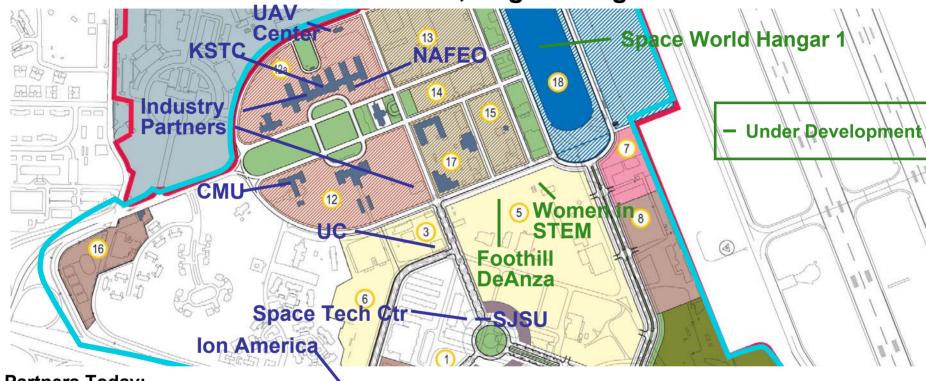






### NASA Research Park

#### Innovative Collaboration in Science, Engineering & Education



#### **Partners Today:**

**University of California- Building 555** 

**Carnegie Mellon University-Graduated the 1st class** 

San Jose State University-Metropolitan Technology Center in Building 583C

Foothill-De Anza Community College-Newly signed agreement

Space World Hangar 1-Non-profit Foundation, raising funds

National Association for Equal Opportunity in Higher Education (NAFEO)-In its second year

**Women in STEM-Formulating Plans** 

Space Technology Center-San Jose State, Stanford, Santa Clara, Utah State /Starting 1st Micro Satellite Classes

**Kentucky Science & Technology Corporation-Building 19** 

Ion America-Building 543 (Fuel Cell Research)

**Industry Partners-Building 566 & 19** 

**UAV Center-Building 18**